

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Transmitted herewith for filing is the patent application
of Charles H. Washburn and Charles O. Gale
for OVEN MERCURY RETORTING DEVICE

Comprising 25 pages of specification and claims, and a
Declaration for Patent Application, Joint Inventors, Including a
Power of Attorney, a Petition and Verified Statement (Declara-
tion) Claiming Small Entity Status (37 CFR 1.9(f) and 1.27(b))
Independent Inventor.

Enclosed also are:

(X) Ten (10) sheets of drawings. (Figs. 1-15) INFORMAL DRAWINGS

23 claims as filed
(Small Entity)

For	Number filed	Number Extra	Rate	Basic Fee
				\$385.00
Total Claims	23-20	3 x	\$11	= 33.00
Independent				
Claims	2-3	0 x	\$40	= -0-
Total Fee				\$418.00

(X) A check in the amount of \$ 418.00 is attached.

(X) A check in the amount of \$ 40.00 is attached for
recordal of assignment.

(X) Please charge any required additional fees to Deposit
Account No. 13-1175 ONLY IF FEES SUBMITTED ARE INSUFFICIENT. A
duplicate sheet is enclosed.

Respectfully submitted,

MALLINCKRODT & MALLINCKRODT

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DATE: Sept. 16, 1997

OVEN MERCURY RETORTING DEVICE

BACKGROUND OF THE INVENTION

1. Field:

The field of the invention is retorting devices for removing mercury from ores and other mercury bearing materials.

2. Prior Art:

The mercury-bearing material may be gold electrowinning sludge, Merrill-Crowe precipitate, smelter gas cleaning sludge, or any other material requiring removal of mercury. The material is commonly placed into an oven adapted for high temperature operation. The oven may be insulated in the interior on walls, top and door with mineral wool board or ceramic fiber cloth. The bottom may be insulated by fire brick or castable refractory material. Trays of the material are heated to volatilize the mercury, the resulting vapor then being directed through condensers, generally water cooled, to liquify the mercury vapor. The oven is subjected to vacuum to promote the volatilization of the mercury during the heating of the mercury bearing material.

Prior art retorting ovens are capable of operating temperatures of only 900-1100°F, a temperature which does not thoroughly remove the mercury. Prior art mercury retorting ovens are unable to be operated under absolute pressures lower than 500-600 Torr, further limiting mercury removal. This is largely because the oven doors warp excessively at very high temperatures, breaking the oven

vacuum seal. The oven and door frames are of common state of the art flange type components, which warp substantially at very high temperatures. Another shortcoming of prior art mercury retorting systems is that the mercury traps can only collect an unseparated mixture of the free mercury and other materials generally present in the condensate.

Therefore a need exists for an oven type retorting device which is capable of operating at much higher temperatures than presently available, in combination with lower operating pressures than are presently available, and that also incorporates an easily cleanable trap with provisions for separating the free mercury from any amalgams or sludge which may be condensed from oven gaseous effluent along with the mercury.

BRIEF SUMMARY OF THE INVENTION

With the foregoing in mind, the inventive mercury retorting device comprises an oven which can be operated at temperatures up to 1500°F, and at simultaneous absolute pressures as low as 50 Torr, said operating temperatures and pressures being achieved through unique oven and oven door constructions. The door employs a continuous, integral peripheral frame comprising hollow tubular members which provide high resistance to heat produced warping. The oven opening is similarly framed, and is also highly resistant to high temperature geometric torsional deflections. If required, cooling air may be directed through the interior of the hollow framing to further reduce distortion at high oven temperatures.

Preferably, a small, continuous flow of ambient air is utilized to purge or sweep the heavy mercury vapor from the bottom of the oven during operation.

Besides the oven, the retorting device further comprises a number of condensers, preferably water cooled, which convert the gaseous mercury effluent from the oven to liquid form, and discharges it into a trap to be collected beneath water along with other condensates. The liquid mercury is subsequently allowed to flow from the bottom of the downwardly sloping trap into a mercury collection pot. A vacuum pump maintains the entire system, other than the final mercury collection pot, under the aforementioned low

vacuum, including the condensers, the trap and the oven.

The mercury trap includes an internal baffle downwardly suspended from the top of the tank trap to below the water surface, to direct the gaseous effluent from the oven upwardly through the first of three condensing stages. A flow conduit then directs the effluent to pass downwardly through a second condensing stage to the space above the water but past the suspended barrier, which recovers further mercury from the oven effluent gas. Finally, the gases then flow from the trap upwardly to be subjected to the remaining condensing stage.

The trap also includes a below-water weir extending upwardly from the bottom of the trap near the lowered outlet end. This barrier prevents the outflow of any heavier metals, amalgams and sludges present in the condensate. These materials are heavier than mercury, so that it may be collected in relatively pure form in comparison to prior art traps, which do not separate these materials.

The trap has clean-out ports through which sludges and the like may be scooped from the bottom of the trap beneath the water using manual tools. This feature increases the safety of the trap by reducing any possible operator exposure to mercury vapor if present.

It is therefore the principal object of the invention to provide an oven-type mercury retorting system with improved efficiency in which the oven may operate at greatly

increased temperatures and greatly decreased pressures, the system also having a trap for condensed mercury which produces mercury of increased purity.

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BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, which represent the best modes for carrying out the invention,

FIG. 1 is a reduced scale side elevation view of the mercury materials retorting device,

FIG. 2 a side elevation view of the mercury trap of the mercury materials retorting device, drawn to a larger scale than FIG. 1.

FIG. 3 an end elevation view of the trap of the mercury materials retorting device, taken along line 3-3 of FIG. 2, drawn to the same scale as FIG. 2,

FIG. 4 a plan view of the retorting oven of the retorting device, drawn to a larger scale than FIG. 1,

FIG. 5 a front elevation view of the oven of FIG. 4, drawn to the same scale,

FIG. 6 a view of a fragment of the oven of the mercury materials retorting device, drawn to a reduced scale larger than the scale of FIG. 5, having a cutaway portion showing the welds securing the oven dome to the tubular door frame,

FIG. 7 an enlarged scale view of a fragment of the oven of the retorting device, showing the door retaining toggles, drawn to the approximate scale of FIG. 6,

FIG. 8 a vertical cross sectional view of the oven of the retorting device, showing the retort material pans within the oven, heating elements and air inlet and gaseous effluent outlet pipes, drawn a larger scale than FIG. 5,

FIG. 9 a front view of the oven of the retorting device with the door thereof removed, showing the retort material pans and the sealing plate about the open end of the oven shell, drawn to the scale of FIG. 8,

FIG. 10 another elevation view of the front end opening of the oven, drawn to a somewhat smaller scale than FIG. 9,

FIG. 11 a cross sectional view of a fragment of the oven of the retorting device, showing the tubular frame members about the open end of the oven, the seal plate, and the seal retaining projections, drawn to a larger scale than that of FIG. 9,

FIG. 12 a front view of a fragment of the front end opening of the oven, showing the seal plate and the seal, taken along line 12-12 of FIG. 11, drawn to the same scale,

FIG. 13 a cross sectional view of a fragment of the oven of the retorting system showing the seal member and the seal compressor of the tubular door frame as well as the seal plate, and the tubular oven frame, drawn to a larger scale than FIG. 12,

FIG. 14 a perspective view of a fragment taken at one of the corners of the oven frame, indicating the mitred, continuously welded ends of the tubular frame members, drawn to a smaller scale than that of FIG. 13, and

FIG. 15 a horizontal sectional view of the oven of FIG. 8, taken along line 15-15 thereof, drawn to the same scale, showing the sweep air inlet tube.

DETAILED DESCRIPTION OF ILLUSTRATED EMBODIMENT

An oven mercury retorting device 10 in accordance with the invention is shown in FIG. 1. The material to be retorted is first placed in an oven 11 where it is subjected to temperatures as high as 1500° at simultaneous pressures as low as 50 Torr.

Pans 75 for retorting material 83 are placed into oven 11, supported by brackets 76 extending from the oven wall 68. (FIGS. 8 and 9) Forklift guides 77 enable each pan to be placed within and removed from oven 11. Horizontally positioned heating elements 78 extending between the pans 75 are supported from rear wall 79 of oven shell 68 and by brackets 80 within oven 11. Cooling down air inlet piping 81 pierces the top of body shell 68. During operation, gaseous effluent outflows through passage structure 12 to mercury trap 13, urged by a small continuous flow of ambient air allowed into the oven through orifices 87 in the end leg 88 of a serpentine tube 89, preheated by flow through preceding legs 90. (FIGS. 8, 9 and 15)

An important feature of the oven assembly 11 is this sweep air tube 89, located on the bottom of oven body shell 68, laying upon insulating fire brick 92. (The oven body 68, and door 32 also carry conventional internal insulation, however not shown.) Air entering tube 89 is warmed by conduction before emerging from spaced apart holes 93, directed horizontally parallel to the fire brick 92 toward

the gaseous mercury outlet piping 12 leading to mercury trap tank 18 and condensers 14, 15 and 16. (FIG. 1) The flow of air, although small to avoid significant effect upon the internal pressure of the oven, prevents the heavy mercury vapor from pooling in the bottom of oven 11. From the oven the volatilized mercury travels through passages 12 to the condensing and trap combination 13, impelled by air allowed to enter oven 11 through serpentine tube 89. (FIGS. 8, 9 and 15)

The trap 13 is partially filled with water and is connected to water cooled condensers 14, 15 and 16. A downwardly reaching barrier 85, indicated in dashed lines in FIGS. 1 and 2, directs the gaseous effluent from the oven 11 upwardly through condenser 14, and thence by passage member 17 to condenser 15 back into the trap 13. The effluent then passes above the surface of the water in the tank 18 of trap 13 and upwardly through condenser 16.

Condensed mercury falls by gravity from each of the condensers back into the tank 18 of the trap 13 to be covered by the water. The trap 13, as well as the oven and condensers, are maintained at pressures as low as 50 Torr, which greatly aids in the volatilization of the mercury from the retorted material.

The gaseous mercury condensed and deposited into trap 13 is periodically removed through valve 20 into a mercury pot 19. To separate the mercury from other materials such

as zinc or cadmium which may have been vaporized and carried over into trap tank 18, a weir plate 21 is provided near the tank outlet end 22. (FIG. 2) Weir 21 allows the liquified mercury to flow to the outlet removal piping and valve 20, while the solid amalgams of mercury with other metals, sludge and the like are retained upstream of the weir 21 within the trap tank 18. A pair of bottom clean-out ports 23 and 24 permit sludge and the like which may accumulate after extended use to be removed from beneath the surface of the water, to minimize the exposure of the operator to any remaining liquid mercury. (FIGS. 2 and 3)

A drain valve 25 aids in the cleaning, often obviating the necessity of removing cap plate 26. (FIG. 3) However, the bottom clean-out ports are used infrequently. A manual dipping tool, not shown, is used through the upper ports for routine clean out. The bottom sludge accumulates principally in the vicinity of weir 21.

After the vapor, principally air, remaining in the trap and the rest of the system including the oven 11, and the connecting passage 17, is drawn off through the vacuum pump 20, it is directed through a mercury vapor scrubber 31. (FIG. 1)

Unique structural framing features of the oven door 32, and the oven end opening 33 enable the oven to operate at pressures down to 50 Torr with simultaneous temperatures up to 1500°F. Door 32 closes one of the ends of oven 11.

(FIGS. 4-8) Hinge assembly 34 permits the opening and closing of door 32. Chairs 35 permit connection of spring loaded toggles 72. (FIG. 5 and 7) The main body shell 84 of the oven door 32 is dished outwardly providing a dome structure 44 to resist the inwardly directed unbalanced air pressure during use, while clearing oven trays 37 and tray brackets 38 interior to the oven. (FIGS. 5, 8 and 9) The outwardly dished structure is further stiffened by ribs 39 welded to dome external surface 40. The domed structure contributes substantially to torsional rigidity of the door at high temperatures, but lightweight frame 41 provides needed extraordinary rigidity at very high temperatures. (FIGS. 4, 6, 7 and 13) Frame 41 comprises hollow steel tubular members 42 and 43, to which dome shell 84 is continuously welded all around its periphery. (FIG. 6 and 13) The frame members 42 and 43 are end-mitred and joined together continuously by a weld 86 at all corner junctures, in the same manner as are the oven framing members 62 and 63. (FIG. 14) This provides a rigid, completely integral structure, which is dimensionally stable at high temperatures. Both oven frame 50, with hollow members 62 and 63, and door frame 41, with hollow members 42 and 43, may carry spaced apart nipples 91 allowing circulation of cooling air, if needed to prevent distortion at high oven operating temperatures. (FIGS. 13, 6 and 7)

The door is supported from the outwardly bulging dome

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44 by hinge assembly 34, which is attached through pivots 45 and 46 onto bracket 47 at the center of door 32. The opposite end of hinge assembly 34 is secured to pivot 48. Hinge attaching brackets 49 are welded to oven door opening frame 50. (FIGS. 4 and 6) Hinge 34 comprises plates 60 welded together to form a frame which is diagonally stiffened by the brace plate 61.

The oven opening frame 50 comprises hollow tubular members 62 and 63 encircling the front of oven 11, with mitred ends continuously welded together at all corner junctions. (FIG. 14) Frame 50 is stiff and torsionally stable at high temperatures and is further stiffened by a seal flange 64 secured thereto by continuous welds 65 and 66 all around the front opening of the oven. (FIGS. 11-13) The inside perimeter of seal flange 64 is continuously secured to oven body shell 63 all around by weld 67.

Seal flange 64 is offset rearwardly from the end 69 of oven body shell 68. A multiplicity of metallic seal holders 70 are spaced apart all around the seal flange 64, about oven body shell 68. Inwardly directed unbalanced pressure during oven operation tends to push seal 71 away from spaced apart holders 70, but against the protruding end 69 of oven body 68. This manner of use of the seal holders 70 eliminates expensive machining of a continuous, seal accepting groove all around the seal flange.

The seal member 71 comprises 3/4" x 3/4" braided

fiberglass strands. Such fiberglass "rope" is readily available on the open market. (FIGS. 12 and 13) To assure that seal rope 71 is reliably engaged when door 32 is closed and secured by toggles 72 (FIG. 7), a steel compressor 73 is provided continuously welded all around the rearwardly facing surface 74 of door frame members 41 and 42. 1/4" x 1/4" steel key stock may be utilized for compressor 73. (FIG. 13)

The inventive apparatus may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present apparatus is therefore to be considered illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A device for retorting mercury bearing materials, comprising:

an oven for heating the materials to volatilize the mercury, condensing means for liquefying the resultant gaseous mercury, trap means for collecting liquid mercury outflowing from the condensing means, receptacle means for collecting the liquefied mercury from the trap, vacuum means maintaining trap, condensing means, oven and connecting passages at sub-atmospheric pressures and means scrubbing the finally condensed gaseous affluent to remove remnants of mercury therefrom; wherein

the oven, condensing means, mercury trap, and connecting passages are capable of operation in the range of internal pressures from 50 Torr to atmospheric with simultaneous internal oven temperatures in the range of 500 to 1500°F.

3. The retorting device of claim 2, wherein:

the oven front opening frame is continuously welded to a seal plate all around the front opening, the seal plate being continuously welded all around to the oven shell at the open front portion thereof, the seal plate carrying means for retaining the sealing member all around the front portion of the body of the oven; so that

the oven is sealed against entry of air thereinto when the door is secured to the open front portion of the oven body in contact with the sealing member retained all around the oven front opening.

4. The retorting device of claim 3, wherein:

the seal plate is welded to the outside surface of the oven shell, positioned rearwardly of the frontmost edge of said shell;

the seal plate carries projection means spaced outwardly from and all around the frontmost edge of the oven body; so that

the sealing member may be retained upon the seal plate between the projection means and the adjacent portion of the oven shell, the sealing member being of sufficient thickness for the rearmost portion of the door to bear sealingly thereagainst all around when the door is secured in oven closing position.

5. The retorting device of claim 4, wherein the door frame further comprises:

a continuous seal compressing member of lesser width than that of the sealing member, rearwardly projecting from the rearward face of the door frame all around, positioned and proportioned to everywhere bear against the sealing member when the door is secured to the open front portion of the oven body in oven closing position.

6. The retorting device of claim 3, wherein:

the frame about the open front portion of the oven comprises;

continuous tubular steel members with identical cross sections and mitred ends joined together by a continuous endless weld to form each corner juncture, said frame being continuously welded to the seal plate; and

the door body frame comprises;

continuous tubular steel members with identical cross sections and mitred ends joined together by a continuous endless weld to form each corner juncture, said frame being continuously welded to the periphery of the shell body of the door.

7. The retorting device of claim 6, wherein:
the tubular members of the door body frame bear
sealingly against the sealing member all around.

8. The retorting device of claim 6, wherein the door
frame further comprises:

a continuous seal compressing member of lesser width
than that of the sealing member, rearwardly projecting from
the rearward face of the door frame all around, positioned
and proportioned to everywhere bear against the sealing
member when the door is secured to the open front portion of
the oven body in oven closing position; wherein

the seal compressing member is carried by the tubular
steel door frame members.

9. The retorting device of claim 8, wherein the oven
further comprises:

hinge means connecting the oven door pivotally to the
oven body frame; and

releasable, spring loaded tension members disposed
about the periphery of the oven door, acting between the
frame of the door and the frame of the open front portion of
the oven body shell, for securing the door evenly against
the sealing member.

10. The retorting device of claim 1, wherein the mercury trap thereof comprises:

elongate tank means supported generally horizontally with a volatile oven effluent inlet end thereof elevated above an opposite, liquid mercury, outlet end;

water partially filling the tank means;

condenser means connected to the tank means above the water therein, so that condensate therefrom flows into the water;

means directing gaseous effluent from the oven through the condenser means; and

means for removing liquid mercury from the tank means from beneath the surface of the water while retaining other condensed materials.

11. The retorting device of claim 10, wherein the means for removing liquid mercury while retaining condensed materials other than mercury comprises:

dam means extending upwardly from the bottom of the tank means at the mercury outlet end thereof.

12. The retorting device of claim 11, wherein the condensing means comprises:

three condensers through which the gaseous effluent from the oven is serially directed.

13. The retorting device of claim 12, wherein:

the three condensers are vertically disposed, each having an inlet end and an opposite outlet end; and

the means directing gaseous effluent from the oven comprises dam means extending downwardly from the top of the tank directing said effluent upwardly into a downwardly placed inlet end of one of the condensers, conduit means connecting the upwardly disposed outlet end of said condenser to an upwardly positioned inlet end of another of the condensers, the outlet end of which is placed to discharge effluent into the space above the water, to then enter the downwardly placed inlet of the remaining one of the three condensers, final uncondensed effluent being drawn from the upwardly disposed outlet end of said remaining condenser.

14. The retorting device of claim 1, comprising:

means for introducing a flow of ambient air into the oven to impel the mercury vapor into the trap and condensing means.

15. The retorting device of claim 14, wherein:

the air flow inducing means includes means raising the ambient air temperature to oven internal temperature before flow thereof into the interior of the oven.

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16. The retorting device of claim 15, wherein the flow inducing means comprises:

a metallic tube communicating between the interior of the oven and the ambient air, said tube being of sufficient length to permit the ambient air to be heated by conduction through the walls of the tube to oven interior temperature before emergence of the air from the tube into the interior of the oven.

17. The retorting device of claim 16, wherein:

the heated air emerges into the oven through spaced apart holes in the tube, so as to be distributed across the width of the bottom of the oven at the door end thereof.

18. The retorting device of claim 5, further comprising:

a metallic tube communicating between the interior of the oven and the ambient air, said tube being of sufficient length to permit the ambient air to be heated by conduction through the walls of the tube to oven interior temperature before emergence of the air from the tube into the interior of the oven; wherein

the heated air emerges into the oven through spaced apart holes in the tube, so as to be distributed across the width of the bottom of the oven at the door end thereof.

19. The retorting device of claim 8, further comprising:

a metallic tube communicating between the interior of the oven and the ambient air, said tube being of sufficient length to permit the ambient air to be heated by conduction through the walls of the tube to oven interior temperature before emergence of the air from the tube into the interior of the oven; wherein

the heated air emerges into the oven through spaced apart holes in the tube, so as to be distributed across the width of the bottom of the oven at the door end thereof.

20. The retorting device of claim 17, wherein the mercury trap thereof comprises:

elongate tank means supported generally horizontally with a volatile oven effluent inlet end thereof elevated above an opposite, liquid mercury, outlet end;

water partially filling the tank means;

condenser means connected to the tank means above the water therein, so that condensate therefrom flows into the water;

means directing gaseous effluent from the oven through the condenser means; and

means for removing liquid mercury from the tank means from beneath the surface of the water while retaining other condensed materials, said liquid mercury removing means comprising dam means extending upwardly from the bottom of the tank means at the mercury outlet end thereof.

21. A trap for recovery of liquid mercury from gaseous mercury contained in the effluent from a mercury retorting device, said trap comprising:

elongate tank means supported generally horizontally with a volatile oven effluent inlet end thereof elevated above an opposite, liquid mercury, outlet end;

water partially filling the tank means;

condenser means connected to the tank means above the water therein, so that condensate therefrom flows into the water;

means directing gaseous effluent from the oven through the condenser means; and

means for removing liquid mercury from the tank means from beneath the surface of the water while retaining other condensed materials, said liquid mercury removing means comprising dam means extending upwardly from the bottom of the tank means at the mercury outlet end thereof.

22. The retorting device of claim 6, wherein:

the tubular steel members of the oven frame each carry longitudinally spaced apart nipples each communicating with the interior of the members, so that a flow of cooling air may be impelled through the hollow centers of said members; and

the tubular steel members of the door frame each carry longitudinally spaced apart nipples each communicating with the interior of the members, so that a flow of cooling air may be impelled through the hollow centers of said members.

23. The retorting device of claim 17, wherein:

the tubular steel members of the oven frame each carry longitudinally spaced apart nipples each communicating with the interior of the members, so that a flow of cooling air may be impelled through the hollow centers of said members; and

the tubular steel members of the door frame each carry longitudinally spaced apart nipples each communicating with the interior of the members, so that a flow of cooling air may be impelled through the hollow centers of said members.

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ABSTRACT OF THE DISCLOSURE

A retorting device for mercury containing material, with an oven, mercury trap and condensers capable of operation at pressures from atmospheric pressure down to 50 Torr with simultaneous temperatures up to 1500°F. A dam within the mercury trap permits removal of liquid mercury separate from condensed solid amalgams, sludges and the like. The trap has provisions for removal of the sludges and amalgams from beneath the surface of water within the trap.

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PATENT

DECLARATION FOR PATENT APPLICATION
Joint INVENTORS

As an below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name:

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled OVEN MERCURY RETORTING DEVICE

the specification of which:

- ☒ [X] is attached hereto.
☐ [] was filed on _____ as
Application Serial No. _____
☐ [] and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Applications(s)

Priority Claimed

		Yes	No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	

_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	Yes No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	Yes No

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status-patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status-patented, pending, abandoned)

I hereby appoint Philip A. Mallinckrodt, Reg. No. 14,532; Robert R. Mallinckrodt, Reg. No. 26,565; and A. Ray Osburn, Reg. No. 27,933; all of the firm of Mallinckrodt & Mallinckrodt as my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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	317 First Security Bank Bldg.
	Ogden, Utah 84401

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the

like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of inventor: Charles H. Washburn

Inventor's Signature Charles H. Washburn III Date 8/26/97

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Inventor's Signature Charles O. Gale Date 8/26/97

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Applicant or Patentee: Charles H. Washburn and Charles O. Gale
Serial or Patent No.: _____
Filed or Issued: Filed herewith
For: OVEN MERCURY RETORTING DEVICE

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(b)) - INDEPENDENT INVENTORS

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(e) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled OVEN MERCURY RETORTING DEVICE

described in

☒ the specification filed herewith
☐ application serial no. _____, filed _____
☐ patent no. _____, issued _____

I have not assigned, granted, conveyed or licensed and am under no obligation under contract by law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

☐ no such person, concern, or organization
☒ persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

FULL NAME Summit Valley Equipment and Engineering, Inc.
ADDRESS 450 East 1000 North, North Salt Lake City, Utah 84054

☐ Individual ☒ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Charles H. Washburn	Charles O. Gale	
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
<i>X</i> <i>Charles H. Washburn III</i>	<i>X</i> <i>Charles O. Gale</i>	
Signature of Inventor	Signature of Inventor	Signature of Inventor
<i>X</i> <i>8/26/97</i>	<i>X</i> <i>8/26/97</i>	
Date	Date	Date

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Applicants or Patentes: Charles H. Washburn and Charles O. Gale
Serial or Patent No: _____
Filed or Issued: Filed herewith
For: OVEN MERCURY RETORTING DEVICE

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

- ☐ the owner of the small business concern identified below;
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

Name of Concern: SUMMIT VALLEY EQUIPMENT & ENGINEERING, INC.
Address of Concern: 450 East 1000 North, North Salt Lake City
Utah 84054

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract of law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled
OVEN MERCURY RETORTING DEVICE

- ☒ the specification filed herewith
☐ application serial no. _____ filed _____
☐ patent no. _____ issued _____

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). *NOTE: Separate verified statements

are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27)

FULL NAME _____

ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____

ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made herein on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Charles O. Gale

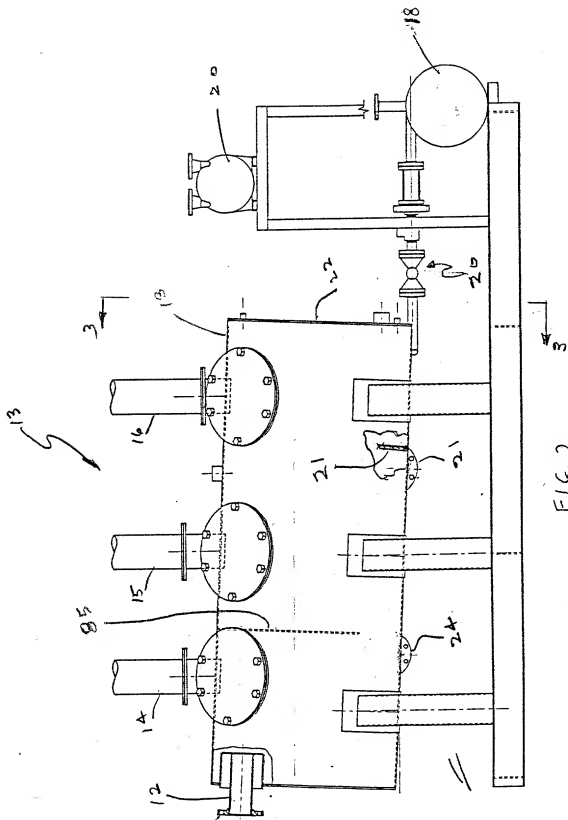
TITLE OF PERSON OTHER THAN OWNER President

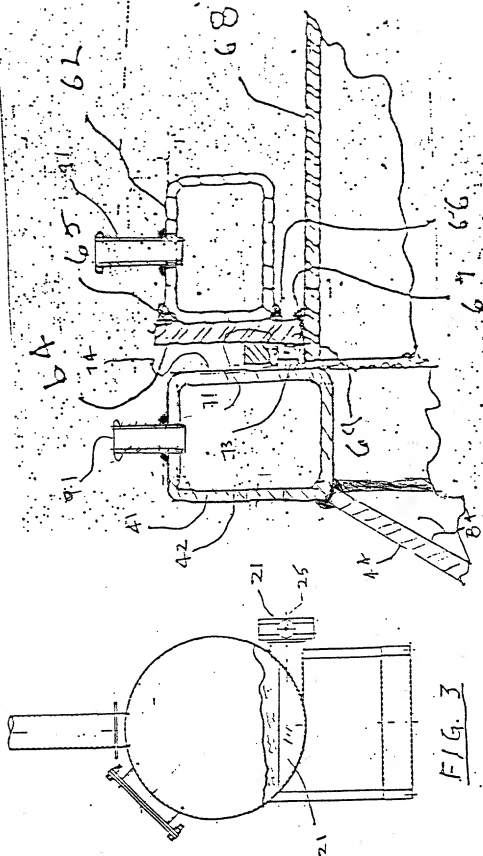
ADDRESS OF PERSON SIGNING 2269 Ridgewood Way, Bountiful, Utah 84010

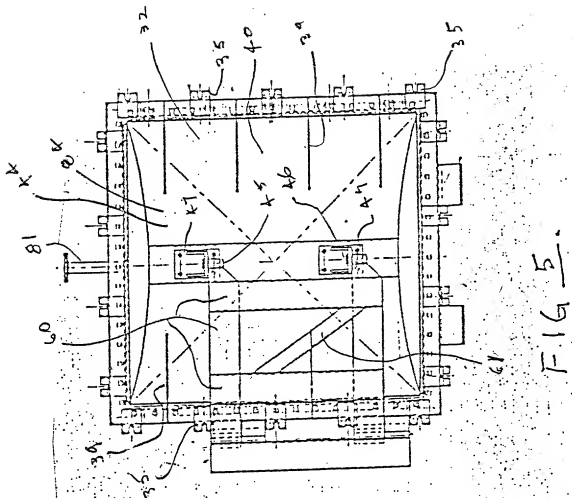
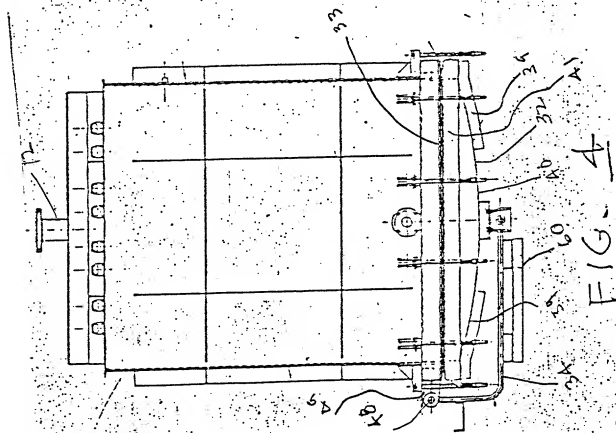
SIGNATURE Charles O. Gale

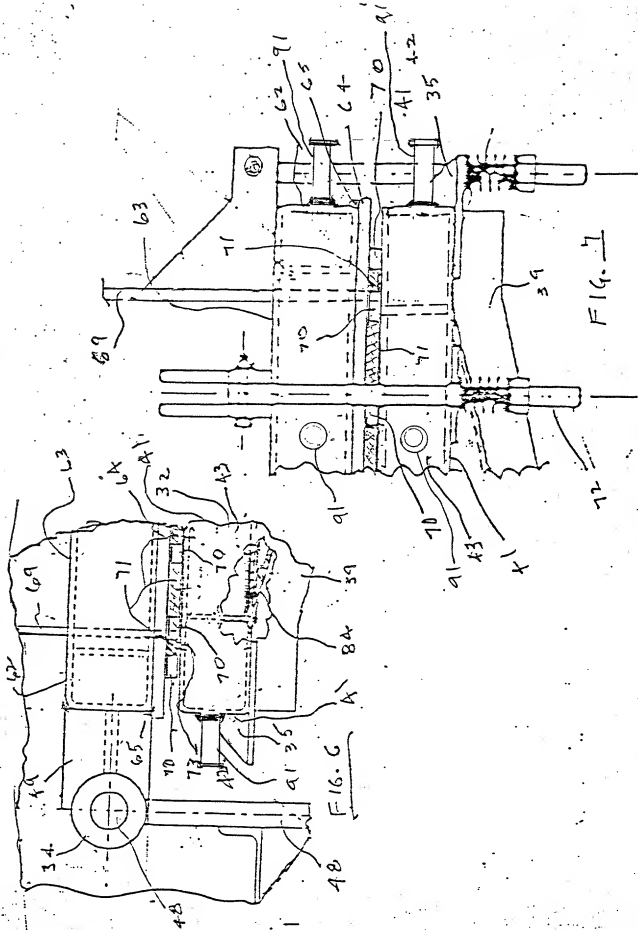
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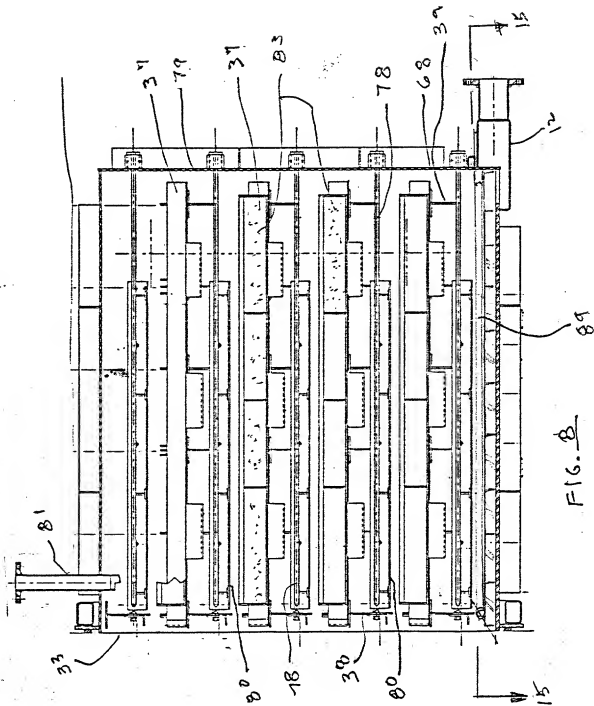
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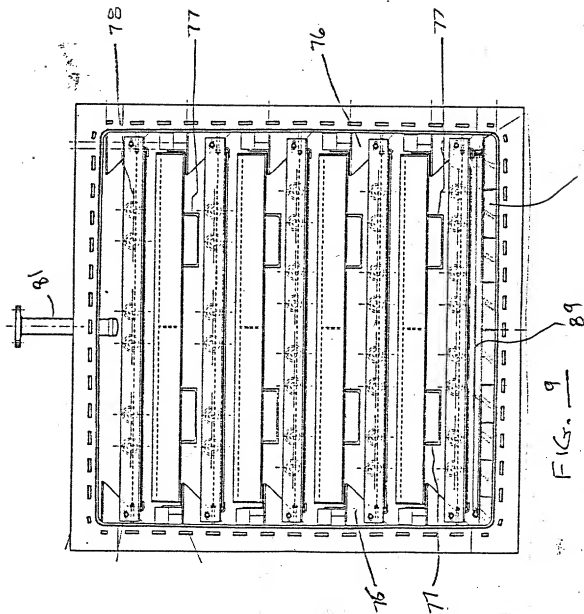








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64

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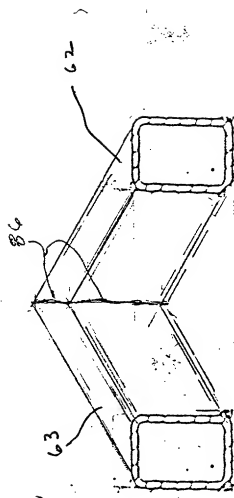


FIG. 14

5 13.75

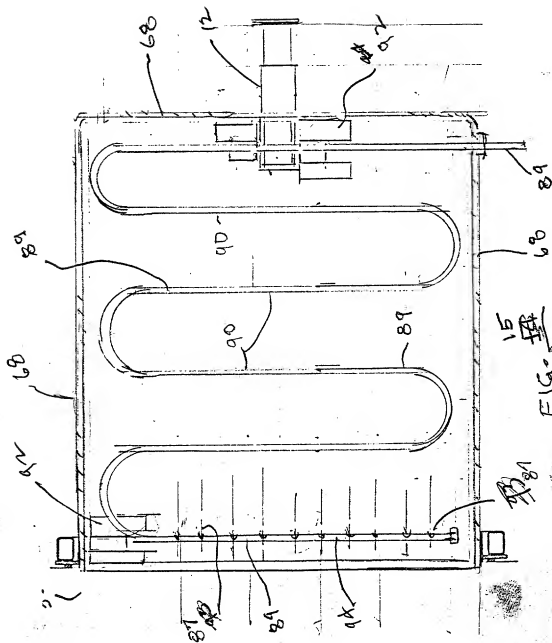


FIG. 15